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SAVING SHADE TREES.

In a list of the various classes of work done by the Street Maintenance Department of Los Angeles is one named "Making necessary investigations to save shade trees, where possible, along the line of improvements." Compare this with an Iowa city, which, because its ordinances required sidewalk paving to be six feet wide with its inner edge two feet from the lot line, refused to spare a line of full-grown shade trees by changing somewhat the location of the sidewalk paving, although there was a space 25 feet wide between curb and lot line, in which to place it. Such vandalism is criminal. Offsetting or curving a sidewalk offers no objections to be considered for a minute when the alternative is the removal of shade trees of many years' growth.

FREE PUBLIC UTILITIES.

The majority of cities make no annual charge for the use of sewers, although we have referred from time to time to several which do. It is generally felt that it is to the advantage of the city as a whole that all buildings be connected to the sewers as a matter of sanitation. Besides, there is comparatively little cost attached to the operation and maintenance of sewers.

That the same ideas should be applied to water service is not so generally maintained, however, and yet a few cities furnish water, or some water, free for domestic consumption, and the majority make no charge, even on the books, for that used in public buildings and for other public purposes. In New Orleans, each house must be furnished free as much water as is needed for bathroom flushtanks and other sanitary purposes, assumed arbitrarily at 1,000 gallons per capita per quarter. Here the same idea is the basis.

But in Santa Rosa, as described elsewhere in this issue, the city furnishes about 50 gallons per capita per day to all residences free of charge. This is much more than is necessary for sanitation, or even for all legitimate household purposes. It is practically free water, with a generous limit to restrict waste. Water is a necessity: but so is artificial light—necessary for safety at the ends of the short winter days, at least. Why not free light in residences? Working men and girls who live far from their places of work must ride—so why not free passage on street cars?

This is not merely an exercise of imagination. Even in conservative old Massachusetts, a bill was introduced in the Legislature a few weeks ago giving a city of that state power to purchase the street railway system and operate

it, charging no fares. There are indications in several recent developments that trial may be made in this country, before very long, of public utilities of various kinds operated at the expense of the taxpayers for the free use of all citizens.

MUNICIPAL AID FOR PRIVATE PLUMBING.

The report for 1918, of the Division of Health of Toledo, Ohio, contained two recommendations that are especially intended to aid the poorer property owners in observing the laws requiring proper sanitation in their buildings. One of these urges a much simpler system of plumbing, stating that the surgeon of the United States Public Health Service, who made a health survey of the city in 1916, had called attention to the injustice of the elaborate system required under the present plumbing code. He submitted a simplified system of plumbing for small houses which would insure adequate and safe means of carrying sewage from the house to the sewer, and which at the same time the already overburdened small property owner could install at reasonable cost.

The other recommendation was that the city create a revolving fund, the object of which would be to asist persons of moderate means to install sanitary plumbing including the connection from the house to the sewer, the cost so paid being made a lien against the property, to be repaid by the owner in annual installments. As is the case with nearly all health boards, probably, that of Toledo has realized that to require certain owners of the smaller class of houses to install and make immediate payment on a complete system of modern plumbing is a hardship, which in some cases might even cause the owner to lose his property. The use of a fund in the control of the bureau or department of health, to be used in this way, would seem to furnish a means of meeting this situation and would probably result in fewer instances of the department refraining from enforcing regulations or ordinances because of pity for the owner.

LOS ANGELES SEWERAGE

Operation of Inhoff Tanks and Other Types of Sewage Treatment Plants, Purchasing Sewer Pipes, Measuring Sewage Flow, Testing Flush Tanks and General Sewer Maintenance.

In his report for the fiscal year 1917-1918, to city engineer A. C. Hansen, the engineer of sewers of Los Angeles, Cal., W. T. Knowlton, makes brief mention of several sewage treatment plans and plants for the several sections of the city, among which the following are perhaps the most interesting.

Imhoff Tanks.—In 1916, the city installed two Imhoff tanks at the Seeley Flats Playground camp. These tanks have given satisfactory operation, and the effluent therefrom receives a sub-surface disposal. During the past year the sewage from the field house of the golf links and the sewage from the buildings in the vicinity of the zoo in Griffith Park have been treated in two Imhoff tanks, each of which was designed by this department for a capacity of 300 persons. At the present time the sewage flow in the tank at the field house has about reached this limit, although the plant is giving satisfaction.

Recently the department has prepared plans for the construction of an Imhoff tank for the Los Feliz detention hospital, and at the present time this plant is being constructed. The capacity of this plant has been designed for a population of 100 persons, and the effluent from the tank is planned to be discharged through a system of sub-surface filters, similar to the disposal in use at Griffith Park.

Other Types of Sewage Treatment.—The experience which other sections of the country have encountered when sewage treatment plans have been proposed, has been found to occur likewise in this city. Reference in this connection is made to the proposed installation of sedimentation tanks of the so-called Skeats type. This type consists of septic treatment of the sewage in long narrow tanks designed to have a very low velocity and a retention period of 24 hours. The sewage is first conveyed through septic chambers, thence through contact filters, and finally passes over a series of trays placed one below the other. The effect of this construction is claimed by the promotors to nitrify the effluent from the contact filter. It has further been claimed that this method of treatment will eliminate all solid matter. In order that an examination might be made of tanks which embody the features above described, the writer has visited several places in southern California, where it was claimed the process was in use. In no case, however, was the discharge found in a stable condition. There seems to be a question whether this method could produce the results obtained by the installation of Imhoff tanks at as low a cost.

The matter of removing solid matter from sewage by installation of screens has also been considered this past year, and recently a study was made in conjunction with the Department of Substructures as to the efficiency of the Riensch-Wurl screen in use at Long Beach. The results of this examination indicated that the screen did not remove more than 20 per cent of the solids from the sewage on the days that the tests were made.

Before leaving this matter of other methods of sewage treatment, it should be noted that the Imhoff tank which was installed by this department and has been in use in East Wilmington for about two and one-half years has given very satisfactory results. No odors or nuisance of any kind have occurred at the plant and the condition of the effluent has been good. The sludge has been removed from the tank at intervals of three or four months' time, and, after drying, has been used for fertilizing purposes.

Concerning sewer construction, Mr. Knowlton reported as follows

Sewer Pipes.—At the beginning of this fiscal year, the department made arrangements to provide for the pipe to be used in the construction of sewers in accordance with instructions from the Council. The method used consisted in obtaining bids from the manufacturers of both clay and cement pipe for the furnishing of the pipe required for each sewer, the pipe specified in the lowest bid to be used. The proposals submitted by these manufacturers stated that the price thereof would be in effect for a period of nine months from the date of the proposals. These bids were for pipe made in accordance with specifications adopted by the city of Los Angeles for the construction of sewers on which bids were received. It was further provided that if 51 per cent of the frontage which would be assessed for the sewers

should petition for either cement or clay pipe, the proceedings would be drafted in accordance therewith.

In order that bids for the construction of cement pipe sewers could properly be received, it became necessary to prepare new specifications for the construction of sewers in which cement sewer pipe would be used. Specifications for cement pipe, which had been adopted by the Council in June, 1917, were inapplicable for the reason that the state law required such specifications to be furnished by the city engineer. In preparing new specifications, the department made an exhaustive study of the matter of cement pipe as used in other cities of the country, and as recommended for use by the American Society for Testing Materials. These specifications covered the use of both clay and cement pipe, and were adopted February 6, 1918. On account of proposed changes since this date, relating to the design and other details required of both of these pipes, a later set of specifications has recently been prepared, embracing several features which will conform with recent recommendations of the American Society for Testing Materials, which society probably represents the best practice in this country. In this connection it has been found that the different tests required of both clay and cement pipes have caused considerable local discussion as to these requirements.

Sewage Flow Records.—To assist in the design of sewage disposal at the harbor, an automatic recording instrument has been used in the lower manholes of the several outfall sewers, which will enable the department the have a continuous record of the sewage flow. The amount of flow treated at the East Wilmington plant has an average of about 160,000 gallons per day.

Sewer Maintenance.—There are 931 miles of house sewers in the 362 square miles of the city, in connection with which are 3,132 flush tanks and 975 flushing manholes. The work of flushing, cleaning, repairing and inspection is done by eight sewer flushers, each in an assigned district. Six of these use automobiles. Each flusher makes daily reports of the tanks flushed. During the year they made 68,272 inspections of flush tanks.

Four gangs were employed regularly on maintenance and reconstruction work. Three small motor trucks and one horse and wagon have been used for transportation of men and materials. During the year there were 93 stoppages of sewers, 84 of which were caused by roots. (An average of one stoppage per hundred miles of sewer from all causes other than roots appears to us to be a remarkably good record.) Changes were made in the elevation of 772 manhole covers. Cleaning services were given to 18,506 culverts and catch basins.

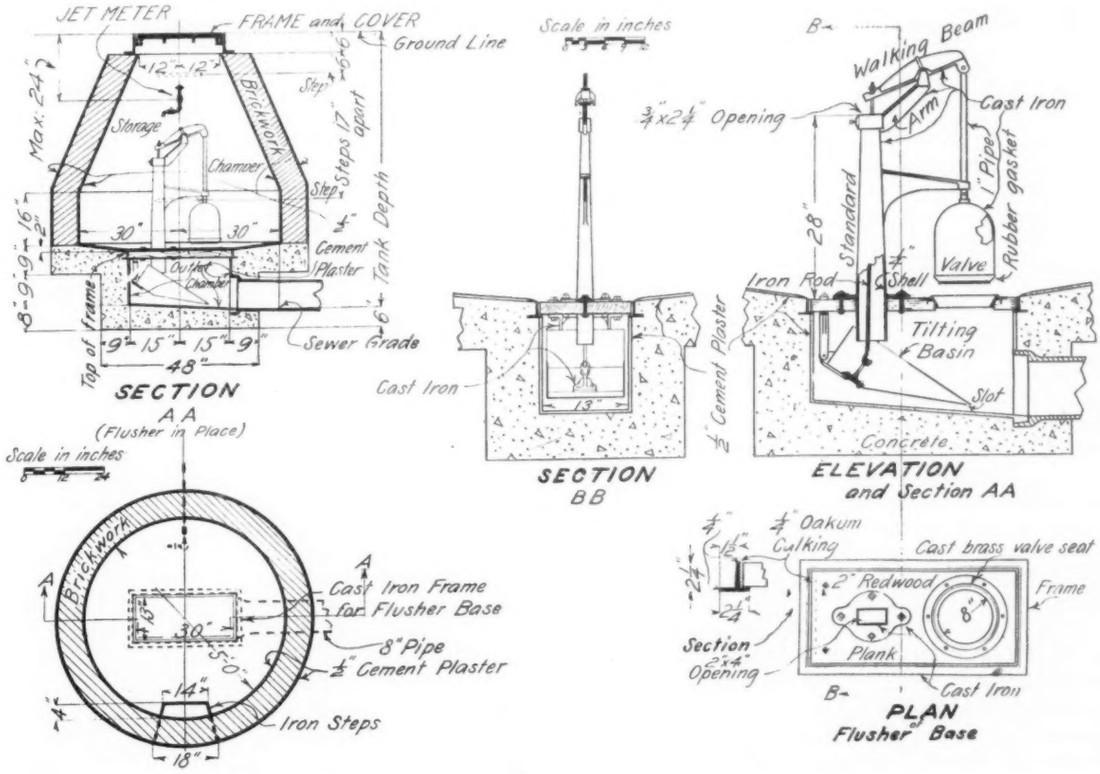
The use of automobiles and trucks permitted the department to reduce the maintenance force by three laborers, one sewer flusher, and one one-horse team and wagon.

TESTING A NEW FLUSH TANK.

By W. T. KNOWLTON.*

In the early part of 1917 the attention of the writer was called to a special type of sewer flusher, the principle feature of which was an automatic arrangement whereby the contents of a flushing chamber, when filled with water to a certain height, would discharge rapidly through an eight-inch opening in the bottom of the chamber directly into the sewer. Also the construction of this flush tank required no excavation below the level of the sewer into which it discharged. The city engineer early in 1918 recommended to the city council that bids be receved for this type of tank in competition with that which had previously been the standard in the city; arranging with the manufacturers of the tank to install one for demonstration purposes in a manhole at the head of one of the lateral sewers which has been operating

*This description of experiments, conducted since the writing of the annual report, has been prepared for Municipal Journal and Public Works by Mr. Knowlton, the engineer of sewers.

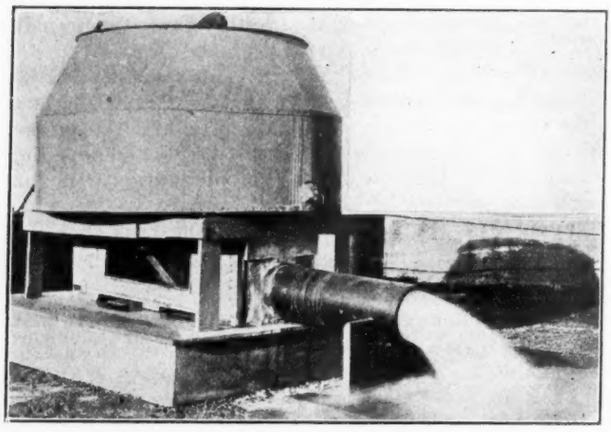


DETAILS OF FLUSH TANK AND FLUSHING APPARATUS.

satisfactorily for eighteen months. In February, 1918, the city engineer was instructed by the city council to receive bids on this as well as the older siphon, and contracts for a few of the new type were let, but on account of war conditions final arrangements for using any of them was postponed.

In the latter part of 1918, the writer, thinking it desirable that a test of the new flusher should be made in order to obtain results under conditions as nearly as possible similar to the working conditions under which the flusher would be used, set up a full-sized flusher, but installed in a steel tank instead of a brick one and with a wooden base with a glass plate for inspection in place of the concrete substructure of the flush tank. The dimensions of this tank were the same as the inside dimensions of the brick flush tank shown on the accompanying plan. The operating mechanism of the flushing apparatus is shown on the same plan.

The sewer is extended as a chamber two feet and a half long, which forms a well hole or outlet chamber in the bottom of the flush tank. This chamber is constructed of concrete and is covered with a wooden base plate that supports a hollow iron standard which is bolted to



FLUSH TANK DISCHARGING DURING TEST.

it. This plate also contains an eight-inch opening lined with a cast brass valve seat, which is closed by a hollow cast iron valve carrying a rubber gasket where it rests in the valve seat. An arm carried by the hollow iron standard supports a walking beam, at one end of which is a rod which carries at its lower end the hollow valve. Another rod attached to the other end of the walking beam passes through the hollow standard and is attached at its lower end to a tilting basin. The weight of the valve is sufficient to hold it in its seat, supporting the tilting basin by means of the walking beam and rod. The tank above the plank floor is filled through a jet meter. When the water has reached the top of the hollow standard, additional water entering the tank overflows into the tilting basin, which is made of either galvanized iron or copper. When a sufficient amount has flowed into the tilting basin, the basin drops to the bottom of the outlet chamber, pulling the valve from the seat and allowing the water in the tank to rush into the sewer. The valve, being hollow, floats in the water until the tank is nearly empty, when it closes by its own weight, the action being similar to that of the valve in the flushing tank of a water closet. The specifications under which this flushing apparatus was purchased require that the tilting basin shall tip when not more than ten gallons has entered it and that the tank shall automatically discharge its contents within a period of not more than thirty seconds and that immediately thereafter the storage chamber shall again become water-tight.

This apparatus was placed in the steel tank above ground as before described and was tested, the operation of the tilting basin being visible through the glass plate. The tank discharged 297 gallons through the eight-inch outlet pipe in 21 seconds in five tests and 22 seconds in the sixth test. This gives a rate of discharge of 14.1 gallons per second in five tests and 13.5 gallons in one test. This is from two to three and a half times as rapid a discharge as was obtained with the type of flushing tanks previously used.

This leads to the question whether it is necessary to have so high a rate of discharge from a sewer flush tank. In investigating the reports and discussions made in connection with the study of flush tanks, the writer has noted that about twenty-one years ago, when a report by Professor H. N. Ogden, of Ithaca, N. Y., was discussed at a meeting of the American Society of Civil Engineers, one member considered that a discharge of at least ten gallons per second was necessary for proper flushing effects. The actual effect of the much greater force produced by this discharge has possibly not received the attention it might have had, and on this account the writer feels that a closer study of the situation could be made to advantage. Although the cost of this flushing apparatus and tank was $30 more than those previously used by the city, it was estimated that if comparison be made between tanks of equal discharging capacity, the tank herein described would in reality be the cheaper, and the city engineer was instructed to use the new tank for all future sewer construction.

SANTA ROSA'S SEWERAGE AND WATER SUPPLY.

Santa Rosa, California, has a population of about 11,000. In 1893, the city issued $165,000 of bonds for installing a municipal water works system, and in 1905 issued $72,500 additional for improving the supply; $5,625 of bonds to be paid off yearly. In 1905 there were also issued bonds for $72,500 for installing and improving the sewerage system.

The water supply system, besides mains, includes a pumping station and reservoir, the pumping plant being driven by electric motors and drawing water from wells. There are about 36 miles of mains, 2,137 residential consumers, 293 business connections, and fire and other connections bringing the total number to 2,602, 100 of which are not in use. Not only is water furnished free to city departments, churches and schools, but each dwelling is allowed 10,000 gallons a month free of charge, all such services being metered. The receipts from the 2,137 residential consumers in the fiscal year 1917-1918 were $1,746, or about 81 cents per connection, the rate being 25 cents per 1,000 gallons. The receipts from commercial rates were $3,643. The expense of operation was $15,891; in addition to which interest and redemption of bonds required $10,651. The bond expenses were provided for by taxes; the deficit in operation was met by transfer from other funds. There was a total transfer from one fund to another during the year of $23,547.

Sewage is disposed of at a sewage farm, from which there was sold last year $710 worth of grain hay, $1,041 worth of alfalfa hay and $40 worth of wood. Hogs also are raised at the farm, and there is an incinerator there. The farm contains 108 acres of land, which cost $43,600. The incinerator is valued at $2,000, and the buildings and sewage disposal equipment at $9,000. Hogs were sold last year for a total of $626. Also $568 was received for pasturage. As against the total income of $2,986, there was an expense at the farm of $1,175, of which

the largest items were $600 salary of farmer, $260 for seed grain, $146 for feed grain, $212 for baling hay, $295 for hog pens, $100 for purchase of 9 hogs and $140 for a farm wagon.

AIR-LIFT ARTESIAN WELL

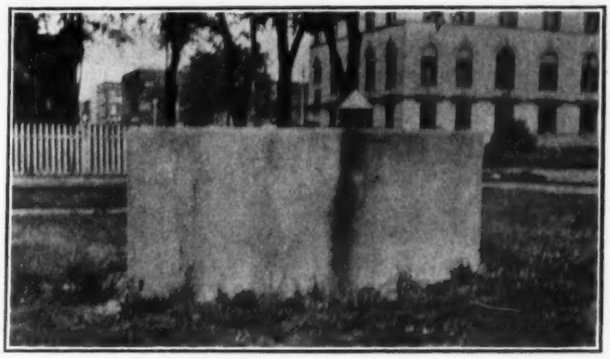
By JOHN OLIPHANT.*

The city of Clinton, Iowa, is provided with water for domestic and public purposes by the Clinton Water Works Company, a private corporation, of which W. L. Meager is superintendent. The supply is secured from some half dozen wells, having a surface flow of limited volume. These are connected so as to flow into a surface reservoir, or they may be direct connected to mains by means of suction pumps.

Experience showed that, when suction was resorted to, the supply was insufficient for the summer heat load or an extended fire demand. Three of the wells were therefore connected with an air-lift system arranged to discharge into the reservoir, using the suction piping as a gravity flow line. A suitable arrangement of valves is provided to permit this flow from the wells to the reservoir while the service pumps draw their supply from the reservoir by suction. By this arrangement, the water supply from these three wells was more than doubled.

The photograph shows one of the 8-inch wells which had a natural artesian flow of about one hundred and fifty gallons per minute. When under suction from the pumps, the pull-down was twenty feet, increasing the flow to five hundred gallons per minute. When this well was connected up for operation under the air-lift, its production was increased to one thousand and thirty-five gallons per minute, the pumping head being fifty feet below the surface. The other two wells, connected up in the same manner, showed a proportionate increase. An umbrella head was placed on the well, permitting the forced flow to discharge into the concrete basin, from which the water was conducted by gravity through the suction line to the reservoir.

*Chief engineer of Pneumatic Pumping Department, Sullivan Machinery Company.



BASIN SURROUNDING 8-INCH WELL.
Umbrella head on top of well casing is seen above the top of the basin.

These wells are handled by means of an air-lift pump, suspended on a 2-inch air line in the 8-inch casing. The air for operating the wells is supplied by a straight-line simple steam and compound air compressor, having a capacity of 558 cubic feet of free air per minute. The installation was effected in a simple and economical manner, piping the air from the receiver to and into the wells. On ordinary service, the pumps secure sufficient supply by direct suction. When an increase is demanded by the summer domestic requirements or by fire, it is merely necessary to start the compressor, throw a few valves, and the supply from the wells is more than doubled.

COMMUNITY HEATING OF DWELLINGS

Economy, Cleanliness and Convenience of Central Station Heating as Compared with House Furnaces—Heating as the Prime Object and Electric Current as the By-Product.

In many branches of industry it is the boast that nothing is wasted. As illustrations we have the utilization of "every part of the pig except the squeal" by the packing houses, the working over of the tailings of stamp mills, the vast number of products derived from petroleum and coal tar. But in the operation of steaming plants, only a small percentage of the available energy is utilized. Mechanical ingenuity has apparently reached almost its limit in the procuring of mechanical horsepower or kilowatt-hour at the switchboard for the least possible evaporative cost. And yet, with units of the highest type and largest capacity, little more than 15 per cent of the heat of the fuel can be converted into a salable product as power in the form of electric energy, while many installations do not deliver more than 6 per cent. The Bureau of Mines of the Department of the Interior advocates, as a partial remedy of this wasting of energy, the combining of a central-station heating system with steam power plants. The following is condensed from a publication by the bureau.

Central-station heating affords an opportunity for a great saving in the total fuel consumed by a community, and at the same time for furnishing electric energy in greater quantity and at a less cost than otherwise. To make such service a success, however, some important factors must be considered and better methods and designs must be worked out. In the late seventies the first central-station heating plant was put in service at Lockport, N. Y. Since that time many others have been installed with varying degrees of success. Much has been done in the development of methods, the perfecting of devices, and the working out of rate schedules and other commercial problems. But in certain directions a great deal of room for improvement remains. An attempt to get information from operating companies on various features of their plants and on operation and maintenance costs was unsuccessful. Had some of these companies responded, specific data might be given instead of the assumptions and generalities on which this paper is based.

BASIS FOR HEATING CHARGES.

The test of any such project is its ability to furnish a satisfactory service for the price that may be obtained. This price is and should be competitive, but unless all of the factors entering the problem are considered at their face value, the results will be misleading. One of the most important factors in the sale of steam for heat-

ing is the economy with which the steam will be used. The early method of charging for the service was based on the amount of radiation installed at an agreed rate per square foot per season. It is easy to predict the fate of the gas or electric company that had to sell its product on that basis to-day. Nevertheless, some of those heating companies survived. A later method was based on the cubic feet of space heated; this was practically the same thing in another form. The present method, and the only proper one, is to meter the condensation and to charge the consumer for the heat supplied as he is charged for any other commodity, leaving him to exercise or not the same economy in the use of the steam that he did in the use of the coal that he formerly bought.

As regards selling steam on the basis of square foot of radiation, it is interesting to note that, although many of the early companies charged a rate of only 20 cents a square foot for a season of 7 to 8 months, the fuel cost of energizing such radiation for a period of only 6 months (180 24-hour days), with an over-all efficiency of 50 per cent in generation and transmission, steam at atmospheric pressure and a room temperature of 70° F., would be from 10 cents to 15 cents with coal at $1 a ton. As few places get their coal at that price, it is easy to see why these heating companies failed. Many electric companies claim a cost of less than 1 cent per kilowatt hour at the switchboard; the public, however, except a few large consumers, pays three to ten times that amount for what it uses. Steam heating can never carry such an excess as that, but there must be a margin for operation, distribution, overhead costs and profit. An attempt will be made in the following analysis to determine what difference exists between the cost of central-station service and of private heating to cover those items.

VALUE OF CLEANLINESS AND CONVENIENCE.

It has been shown above that the average fuel cost of supplying radiation under the conditions named will be about 10 cents to 15 cents a square foot for a season of 8 months with coal at $1 a ton. The cost can be readily computed with coal at any other price. From a series of tests at the engineering experiment station of the University of Illinois, the plant efficiencies for such equipment with the fuels named were as follows:

Plant Efficiencies for Five Fuels.

Fuel.	Average efficiency (per cent).
Illinois coal	48.86
Pocahontas coal	50.20
Anthracite coal	54.00
Gas-house coke	59.63
Solvay coke	61.73

The efficiencies given for Illinois coal are no doubt somewhat higher than will be maintained in practice by the average householder for an entire season. Based on the relative average heating values of the fuels named and with the efficiencies above given, the prices at which the cost of heat would be equalized to the consumer are as follows:

Data on Four Types of Coals.

Fuel.	B. t. u. per pound as fired, average.	Heat absorbed, total value, per cent efficiency.	Cost per million B. t. u., cents.	Prices at which values equalize.
Illinois coal	12,000	5,863	8.53	$1.00
Pocahontas coal	14,750	7,400	6.75	1.26
Anthracite	12,700	6,828	7.28	1.17
Coke	12,000	7,200	7.00	1.22

Thus it appears that with Illinois coal at $1 per ton we could afford to pay $1.26 for Pocahontas, $1.17 for anthracite, and $1.22 for coke. The Illinois coal would therefore be in demand if it were not for other considerations than the cost of the heat. Some cities have smoke ordinances that make it nearly, if not quite, impossible for householders to burn Illinois coal. It also requires more labor to keep up the fires, remove ashes and clinkers, and keep the heating surfaces free from soot. All things considered, Pocahontas coal, anthracite and coke are in demand at one and one-half to three times the cost of Illinois coal.

These differences represent charges against dirt, smoke and excess labor. In other words, they are a contribution to cleanliness and convenience. Taking the Illinois coal at $1 a ton, with a heat value of 12,000 B. t. u. and 49 per cent average efficiency, the cost of energizing a square foot of radiation for one hundred and eighty 24-hour days will be slightly higher than for the central station mentioned above, at which the overall efficiency of generation and distribution was taken at 50 per cent. The fuel costs for the heat are therefore about the same, whether furnished by the private plant or from a central station with the same coal at the same price.

Value of Central-Station Service.—However, there are these differences: The central station can work at a higher sustained efficiency, it can produce electric current as a by-product with only a small loss of heat generated, and it eliminates all of the objectionable features of a private plant.

The development of equipment and methods of operation in the boiler room of the modern power plant leave but little to be accomplished there. Soft coal may be had under contract in Wisconsin at prices ranging from $2.50 to $3.50 a ton on track. It can be burned at an overall efficiency of more than 70 per cent and the product is heat with steam as a medium of transmission. Served in this manner through a distribution system, the heat has a value equivalent to the total cost of all items included in the operation of a private plant plus a considerable allowance for greater convenience and perfect cleanliness, and it should be so estimated in all computations on which costs and rates are based. Whether or not it is exhaust steam in whole or in part has no bearing on the case; any allowance in that direction should affect the price of current and not the cost or the value of the steam. The steam should be considered the prime requisite, with any output of incidentally derived current as the by-product; it will then stand or fall on its own merits, which is the only substantial measurement of its value. The reasons on which this argument is based will be given later.

As regards the generation and the transmission costs and margins, with coal at $3 a ton and an overall efficiency in the plant of 70 per cent, the steam can be delivered at a fuel cost of approximately 30 cents a square foot of radiation served. This allows 20 per cent for loss in transmission, a figure considerably higher than that found in practice, as evidenced by a report in Bulletin 40 of the Bureau of Mines, where this loss is given as 4 to 12 per cent. The same coal will cost the private user about $4 a ton delivered at his premises, and his fuel cost for the same amount of heat will therefore be not less than 40 cents. But he still has the smoke, dirt and labor inseparable from the use of soft coal in such equipment as he uses. How much is the elimination of these objectionable items worth? Based on the relative costs of the soft coal and those substitutes—anthracite and coke—which most nearly accomplish the desired end, so far as smoke and dirt are concerned, it is worth from 100 to 150 per cent more than the estimated cost of the heat as computed at 40 cents, making the real value 80 cents to $1.20 a square foot a season. These values may seem high, but when the economy that is practiced in the use of hard coal at $8 to $9 per ton

is considered, they are probably not far from correct. Storm windows are in evidence at the first frost, ventilation is sacrificed, and no space is heated that is not absolutely needed.

The use of fuel of higher grade eliminates nearly all of the smoke, part of the dirt, and some of the labor; but it is still necessary to provide and maintain a furnace and furnace room, and coal storage, to buy coal, haul out ashes, and do the firing and cleaning. These items may be estimated to cost approximately 50 per cent of the value of the soft coal burned. Assuming that the investment is already made in the private plant, we can make no charge against that except for repairs; these can be neglected, as can also any charge for space occupied by equipment, coal or ashes. Adding the 50 per cent, or 20 cents a square foot as determined above, to each of the costs for the various fuels, gives us rates of 60 cents, $1, and $1.40, respectively, for Illinois coal, anthracite, and coke.

The central station can deliver the heat for a fuel cost of 30 cents, thus leaving margins of 30 cents, 70 cents, and $1.10 to cover labor, maintenance, overhead charges, transmission, and profits. In addition the station has eliminated every objectionable feature of the service and made it a convenience instead of a nuisance. It is a fact worthy of note that central-station heating plants are most numerous where coal is abundant and cheap, as in Pennsylvannia, Ohio, Indiana, and Illinois. This confirms the deductions to be made from the preceding statements, namely, that the elimination of the smoke, dirt, and disagreeable labor are of more value in some cases than the fuel cost of the heat. In the localities cited, this elimination is essentially what the consumer is paying for. The fuel is so convenient and cheap that the central station can offer no inducements in the way of economy and must make its campaign for consumers on the basis of better service and the elimination of all objectionable features.

As stated before, a number of the old companies did survive the period of 20-cent rates; coal was cheap and they had a considerable quantity of exhaust steam which they discounted in making their rates, and the product of the steam—electric current—was sold at a good profit. Still, it is remarkable that they could exist with the fuel cost approximately 12 cents a square foot a season and only a margin of 8 cents left to cover all investment and operation charges.

ANOTHER METHOD OF COMPUTING COSTS.

If the problem be viewed from another angle, the cost of evaporating a given amount of water in the large public-service plant as against the small private plant may furnish a better basis for comparison. With Illinois coal at $1 a ton, the fuel cost of evaporating 1,000 pounds of water (generating 1,000 pounds of steam) should not exceed 7 cents, and in a well-designed and carefully operated plant may be as low as 6 cents. The other costs will increase this figure to about 10 cents, and with coal at $3 a ton the total cost will be about 25 cents. The private consumer can not evaporate the water any more cheaply, even with coal at the same price, and as he will have to pay more for his coal, the cost to him of evaporation will be more. Furthermore, when he only requires a little heat his efficiencies drop very low and his losses are correspondingly great.

In the former estimate of the cost of supplying 1 square foot of radiation for 180 days, a rate of emission of 2.5 B. t. u. per square foot of surface and per degree difference of temperature per hour was used. This rate shows that 1,500,000 B. t. u. will be required to energize 1 square foot of radiation for the 180-day period. In evaporating 1,000 pounds of water there will be a heat transfer of approximately 1,000,000 B. t. u., at a cost of 25 cents with coal at $3 per ton. From these figures it evidently will cost 38 to 40 cents to evaporate the water for each square foot of radiation supplied. To this figure must be added all the investment, operation, and other charges on the plant and distribution system. These can only be approximated in a general estimate, but they will probably equal the fuel cost, bringing the total up to 75 cents or 80 cents a square foot a season. The reader should bear in mind that in the computations made on the quantity of heat emitted the radiation was assumed to be active for the entire period. This will not necessarily hold in practice, and less heat will be required than the amount charged in this discussion. It makes little difference, however, as the lessening will be of about the same amount whether the radiation system is heated privately or from a public-service main.

Rates for Steam.—From schedules of rates in 28 cities of 25,000 to 40,000 inhabitants, covering many of the middle states and ranging in latitude from Michigan and New York to Georgia and Alabama, the highest minimum is $1.50 per 1,000 pounds of steam at Peoria, Ill., and the lowest for maximum consumption is $0.3105, at St. Joseph, Mo. The lowest minimum consumption rate is 54 cents at Penn Yan and Geneva, N. Y., and the rate at these points for maximum consumption is 46.35 cents. The average minimum and maximum rates for the 28 cities, on quantities of 4,000 pounds or less and 300,000 pounds or more per month, are 76.40 cents and 45.33 cents respectively.

Although a study of these rates shows an entire lack of uniformity in the methods of their deduction, the averages confirm in general the costs established herein for furnishing 1,000 pounds of steam. In about half of the schedules mentioned there is a demand charge of $3 a month minimum on all buildings having a capacity of 25,000 cubic feet space or less, and of 12 cents per 1,000 cubic feet on all buildings having more than 25,000 cubic feet.

ECONOMY IN USE OF STEAM.

From the foregoing statement it is evident that economy in the use of steam from a central station is just as important as in the use of coal burned privately. Will the consumer practice such economy? Under meter it may be assumed he will; under flat rates he will not.

The quantity of heat necessary to supply 1 square foot of radiation for a season is probably less than the estimate already given in this paper. Although the heating season is one to two months longer than the period named, there are many days in the early fall and late spring when little or no heat is required. At such times the consumer can reduce his active radiation to any amount desired with less trouble than he can allow his fire to go out and be rekindled. He can also have a little heat in the morning and shut it off for the rest of the day if he desires. A proper demand charge will protect the central station at such times. The station has a decided advantage also, in that the boiler capacity in service can be adjusted to the load and maximum efficiency can thus be maintained.

As with some electric schedules, many rates for steam throw a burden on the small consumer by forcing him to help pay for the large consumer's service. In the case of steam, no consumer should be given service for less than a profitable rate. In rates for electric service there is some justification for the apparent discrimination as between the large and the small consumers. The

former may make their heaviest demands at times when the load is otherwise small and thus increase the station load factor. In a central-station steam plant the load varies but little during the entire day; the demands for steam go up and down with the changes of wind and temperature, but such changes are gradual and give ample time for controlling the operation of the plant so that the highest possible economy can be realized. Daily peaks are almost negligible.

EXHAUST STEAM.

Thus far exhaust steam has not been considered, because there is no difference between it and live steam at the same pressure, and any exhaust steam that may become available for distribution costs just as much and is worth just as much for heating as though a part of its original energy had not been converted into useful work. In a combined plant, the product resulting from such conversion—usually electric current—should be considered the by-product.

Where the heating load is large enough to entirely submerge the power load, there will be no peaks in the boiler room through variations in the latter. The power requirements may vary from zero to maximum and the firemen will not know it unless some one tells them or they consult the records. When the engines are exhausting their maximum into the heating system, the reducing valves will automatically cut the supply of live steam to the required amount; when the power load is a minimum they will open and supply live steam to meet the requirements.

CORRELATION OF LOADS.

The relations of loads have an important bearing on the subject of central-station heating. When the heating load is made large enough to give constant conditions in the boiler room, the efficiency there is decidedly increased and the power output becomes a matter of secondary importance as far as cost of operation is concerned. Although for commercial reasons, the keeping of the station load factor for power as high as possible is desirable, peaks and variations of any magnitude within the range of the boiler capacity can be handled with a minimum of trouble and expense.

The early efforts—and, perhaps, those of the present—sought to adjust the loads in a combined power and heating plant so that the exhaust steam, considered as a by-product, would do the greater part of the heating, as much live steam as might be necessary being introduced in severe weather. In the average central station such adjustment is practically impossible because of the wide variations in the power requirements during the day and the comparative uniformity of the heating load. In consequence, some exhaust steam is wasted during part of the day and considerable live steam is required at other times. This procedure leads to the establishment of heating service rates that are too low, and it is wrong in principle for the reason that it discounts the value of exhaust steam. Fortunately, in some of the successful plants the heating load crept up until a favorable relation existed and, had the hates been equitable, a much better showing could have been made. Where the service is good it is not difficult to book all of the business, or a satisfactory part of it, along the mains. The central station that can supply both heat and current stands a much better chance of displacing the isolated plant than the one that can bid for the current only.

In cities of medium size the same boiler capacity that can supply three to four blocks with current will heat only about one. This fact should make it comparatively easy to take on a suitable heating load within easy distance of the plant where the latter is situated favorably with regard to the district served. By a suitable heating load is meant one in which the power ceases to be a factor so far as the boiler requirements are concerned. As regards steam that has passed from a higher to a lower pressure by doing useful work in an engine, it is in a way analogous to water that is used for irrigation, navigation, or any other purpose after it has driven the wheels of a power plant. The quantity of water remains the same, and if it still has sufficient head or depth it will irrigate as much land or float as large a boat. The steam, after it has passed the engines, will do nearly as much heating as it would before. The current generated may vary from zero to maximum, with only a trifling increase in the quantity of fuel required.

For this reason the steam should be considered the prime requisite and any current produced should be considered the by-product. The latter will be cheapened somewhat by the process and a correspondingly greater number of people will be benefited by the combination. Also, the fuel will be utilized more efficiently.

HOT WATER AS HEATING MEDIUM.

Steam is most generally used as the medium for conveying the heat to the consumers, although hot water has its advocates, and in some ways it has advantages. Where hot-water radiation has already been installed it is a simple matter to put in a small heater and use the steam for heating the water instead of heating it directly by a coal fire. Nearly any kind of steam or hot-water system that a consumer may have can be satisfactorily operated from the central station mains by using the necessary devices for pressure regulation and control. All installations should have thermostatic regulation if the best economy is to be maintained.

GOOD ENGINEERING NECESSARY.

The design, materials of construction, and the methods of operation of district steam-heating plants require careful consideration by competent engineers to insure the success of each installation. Generally, the pipe lines have been iron or steel pipe, several times heavier and stronger than necessary for the pressure carried but failing rapidly by corrosion. It is a false economy to use material not permanently resistant to destructive agents. The pipe is only one item of the underground expense, and means should be devised of making it durable. The best is the cheapest where a long life with low maintenance cost is necessary to success.

The practice has been to lay the mains in the streets or alleys. This is desirable wherever possible. However, in mine and mill work the mains are frequently carried considerable distances overhead. Tunnels are convenient, but their cost is generally prohibitive except in the largest cities. Our city planning should include better provision for underground services than is to be had at present. The streets are practically the same in width and surface arrangement that they were 50 years ago, when gas and water were the only utilities requiring space; at present there are some six or more besides the sewers, and the number will increase.

RECOMMENDATIONS.

Based on the foregoing discussion it would appear advantageous to—

Select plant locations favorable to the district to be served.

Adopt more permanent construction materials and improved designs.

Submerge the power load entirely at all times during the heating season.

Put all consumers on meter rates with an equitable demand charge.

Run compound engines, or exhaust the turbines tandem to simple engines during the summer months.

TEMPERATURE EFFECTS ON CONCRETE RESERVOIR.

During the year 1917 the city of Newton, Mass., built an extension to what is known as the Waban Hill covered reservoir, but water was not admitted to this extension until after the winter of 1917-1918, the cold weather of which subjected the exposed concrete to unanticipated temperature changes.

The Newton water supply is obtained from underground sources, and the temperature of the water only varies some 10 degrees Fahr. during the year. A covered reservoir containing such water is therefore subjected to but slight temperature stresses, and this structure was designed with the expectation that the whole work would be completed and filled with water during one season, thus doing away with the necessity for more than a minimum allowance for expansion and contraction during construction. The work was started so late in the season of 1916 that only the greater part of the floor area and walls were completed. The reinforcement in the floor, however, distributed the contraction stresses so that only hair cracks were apparent in the winter time, and the expansion joints provided in the walls proved adequate. It was noted that some of these latter joints did not open at all, and others a substantial amount while exposed during the cold weather of the winter of 1916-1917.

The winter of 1917-1918 was of unusual severity, the thermometer on occasions registering below zero several days at a time. On January 2, 1918, the temperature of the completed sections was tested and found to be 33 degress Fahr. On the morning that this observation was taken, the temperature of the outside air was below zero Fahr. and had registered below zero Fahr. for five successive prior mornings. Although the loam filling and the groined arch roof were frozen solid, as evidenced by the frost adhering to the under side of the arches, yet no cracks were apparent in the concrete of the roof, the only effect being that the construction joints along the crown of the arches opened up sufficiently to indicate their location, but without apparent impairment of the stability of the roof.

BURIED STREETS OF SAN FRANCISCO.

A part of the city of San Francisco extends into a country of sand dunes, and the continuous shifting and irresistible progression of these dunes is one of the most serious problems that the city has to face. The dunes in many cases move across a street so as to entirely bury it and make it impassable, as shown in the accompanying illustrations.

The city has tried many remedies, but none has yet proved entirely successful. The most satisfactory one found so far is the combined use of a bulkhead and the growing of Texas grass on the sand back of it. The

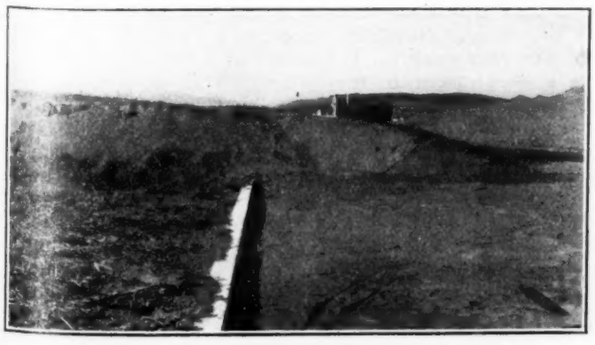


FIG. 1—SAND DUNE CROSSING STREET.

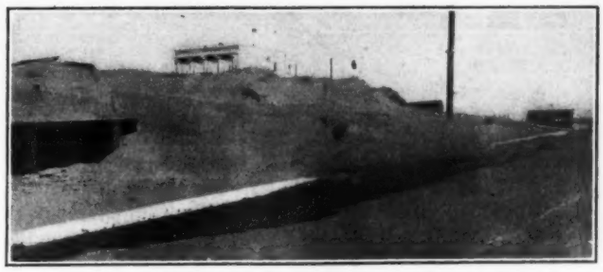


FIG 2—SAND OVERTOPPING BULKHEAD AT STREET LINE.

bulkhead alone, at least carried up to the height shown in Fig. 2, does not solve the problem, but is in places buried by the drifting sand. Texas grass, when once started on the sand, seems to grow about as fast as the sand piles up, the top of the grass always projecting a little above the sand. It continues to grow in this manner even though the sand may reach a depth of eight or ten feet above the place where the grass is originally planted. With the entire building up of a section and cultivation of the land surrounding the residences, a large part of the difficulty probably will disappear; but for the present it is a problem that has not yet been satisfactorily solved and on which considerable amounts of money are being spent.

SET-BACK LINES IN NEWTON.

In his annual report for the year 1918, as city engineer of the city of Newton, Mass., Edwin H. Rogers makes brief mention of the carrying out of the policy of establishing building or set-back lines which had been adopted in the year 1917. At the end of 1918 such lines had been established on seven new streets and on portions of two old streets. The length of frontage of abutting property on which building lines were established in 1918 was 3.4 miles, making the total amount of building lines established up to that time 4.33 miles.

"The establishment of building lines on Center street, providing for a set-back of from 35 to 40 feet for a distance of a mile on each side, is a noteworthy instance of the advisability of this policy, and a similar procedure is strongly advocated for many of our existing thoroughfares with a view not only to provide streets of better appearance, but also to preclude in many cases the erection of commercial buildings on the existing street lines, thereby rendering future widenings in such places unduly expensive."

On the eight streets other than Center street, the set-back was ten feet in each case, the lengths of street affected varying from a minimum of 178 feet frontage to a maximum of 2842 feet, except for Center street, on which the restriction covered 9453 feet of frontage.

TO SUPERVISE FEDERAL AID ROAD WORK.

Thomas H. MacDonald has been appointed by the Secretary of Agriculture in immediate charge of work done under the Federal Aid Road Act. Mr. MacDonald, who is now chief engineer of the Iowa State Highway Commission, will assume his new duties as soon as he can close up his work in Iowa, in the meantime keeping in close touch with the Federal Aid work. It is planned that, in the near future, he assume the position of Director of the Bureau of Public Roads made vacant by the death of Logan Waller Page. He will immediately supervise and direct all the activities of the Bureau of Public Roads under the Federal Aid Road Act, including the expenditure of the additional appropriation of $209,000,000 provided by the Post Office Appropriation Act passed a few weeks ago.

The WEEK'S NEWS

Proposed $75,000,000 Road Bonds for Texas—War Explosives for Road Work—Pennsylvania's Highway Plans—State Quarantine Law Follows Jersey Influenza Fights—New York Harbor Pollution Case Reopened—Hundreds Sick in Lansing from Water—All Metering in Niagara Falls—Electric Power Plant Census in New Jersey—Los Angeles Mayor Indicted on Vice Bribe Charge.

ROADS AND PAVEMENTS

To Vote on $75,000,000 Road Bond Issue.

Austin, Tex.—The proposed constitutional amendment to provide that the state issue $75,000,000 in bonds for the purpose of building roads in Texas has been adopted by the legislature. The resolution proposing the amendment asks that the people vote to give the authority for the issuance of the bonds and handling and disposition of proceeds therefrom is left to subsequent legislatures, as is the method of retiring the bonds.

Illinois Legislature Investigates Road Material Prices.

Springfield, Ill.—Subpoenas numbering 250 have been issued by the joint legislative committee appointed to investigate costs and profits in road construction materials. Hearings will be held here and Chicago. A number of prominent Chicago paving and cement contractors and officials of stone, terra cotta, brick and lumber companies are expected to give the committee definite information on building costs. The inquiry will include an attempt to learn whether or not profiteering exists in steel, cement, brick, plumbing and other material lines. The committee will also consider the feasibility of the state's entering upon the business of producing road materials. Senator John Dailey, of Peoria, is chairman of the committee.

TNT for Road Work.

Washington, D. C.—Ten million dollars worth of high explosives mostly consisting of TNT have been turned over by the War Department to the Department of the Interior for reconstruction purposes. It is reported that Secretary Lane, of the Interior Department, plans to use much of this material for blasting on road construction work.

State's Share in Pennsylvania Road Work.

Harrisburg, Pa.—Highway commissioner Lewis S. Sadler has issued a statement explaining the method of county cooperation in the construction of secondary roads throuhout Pennsylvania, and urging greater activities on the part of county authorities. A trans-Pennsylvania north-south and east-west highway will constitute the state's primary road system. The cost of this system will be met entirely by the state, from the sale of bonds authorized at last November's election. Its construction will give Pennsylvannia a network of permanent main highways. In order that not only the state at large, but its thousands of communities may get the benefit there will be a secondary system of roads—connected with the primary system. To secure this secondary system the commissioner says it will be necessary that every Pennsylvannia county cooperate with the commonwealth. Each Pennsylvannia county is entitled to a portion of what is called the state-aid fund. The state shares with the several counties on a 50-50 basis. The counties arrange their portion of the 50-50 expenditure as they see fit, insofar as the division between county and townships is concerned. The state will follow preferences indicated by county commissioners as to the thoroughfares on which work will be done on the state aid plan. But the total represented by what the state and the counties will spend on state-aid roads does not truly represent the total that will be spent on the construction of secondary highways. The state highway department takes the position that because the state alone is paying for the main or primary highway system, the counties themselves should be willing to put into the construction of secondary routes the money they would have spent had they been called to meet the state in cost of construction of the primary system. In other words, a county's share of the state-aid fund for the two-year period covered by the legislative appropriation may not be sufficient to do extensive construction on the secondary system. The commisssioners of that county have authority to borrow money or issue bonds as they see fit. If they use it to construct permanent roads on state highway routes then, upon completion of the thoroughfare, the state assumes the maintenance and repair. Several counties have already issued bonds for road work, a dozen counties have bond issues in prospect, and many others will if necessary borrow money with which to aid in the construction of permanent sections of secondary highways. Almost every county in the state has indicated that it will avail itself of the state-aid apportioned to it under the law.

SEWERAGE AND SANITATION

City Officials Controlled by the Quarantine Bill.

Trenton, N. J.—The senate has passed a bill to strengthen the powers of the state department of health by giving it explicit authority to close places of public assembly and resort during epidemics. The bill is intended to prevent the recurrence of such a situation as developed last fall during the influenza epidemic, when certain municipalities, including Newark and Jersey City, refused to comply with instructions from the state department of health to close such places in order to safeguard the public against the spread of the epidemic. Mayor Gillen, of Newark, it will be recalled, put the order of the state department in effect when promulgated, but subsequently modified the order, without authority from the state department, by permitting saloons to sell liquor through their side doors. The Newark mayor still later permitted some other places of public assembly to open before the quarantine had been lifted by the state department, and finally declared the quarantine lifted so far as Newark was concerned without awaiting such action by the state department. Mayor Hague, of Jersey City, also permitted the saloons to open. Efforts by the state department to obtain full compliance with the quarantine order in both cities resulted in open defiance, and when the state department consulted legal advice it learned that while the existing law apparently gave it full power to safeguard the public health, the grant of power to establish and enforce a state-wide quarantine was very doubtful, if existent at all in the law. The bill is a supplement to the act which created the state department of health. It provides that "whenever a dangerous epidemic of any communicable disease shall exist in any municipality of the state, and in its judgment such action shall be necessary to check or abate the further spread of such epidemic," that department shall have "power, by the order, and during the prevalence of such epidemic, to close all such stores, saloons, churches, schools, public and private, theatres and places of public amusement and resort in such municipality as it shall deem wise and expedient, and to prohibit public meetings and assemblies." Such order under the proposed law would be immediately effective, being published by adver-

tisement or posting and sent by registered mail to the proper municipal officials, and it is made the duty of the police of the municipality to enforce the order. In the absence of the board of that department, the president of the board is given power to act. Penalty for non-compliance by any person or establishment against which the order is directed is made $100, and each day during which the order is disobeyed is made to constitute a separate offense. Any mayor, director of a department or chief of police declining to enforce the order is made subject to a fine of $500. Provision is made for prosecuting those coming in conflict with the law, but there is no provision for its physical enforcement by the state in the case of refusal of municipal authorities to act, beyond the imposition of the fines mentioned.

Supreme Court Reopens Big Sewage Disposal Case.

New York, N. Y.—The United States Supreme Court has ordered reopening of the suit brought by the city of New York against the Passaic Valley Sewerage Commission, or as the case is legally entitled, the State of New York against the State of New Jersey. The suit was originally brought in October, 1908, to prevent the alleged pollution of the waters of New York Bay by the treated sewage of Newark and other communities included in the Passaic Valley Sewerage District. Testimony was taken from June, 1911, to June, 1913, but the case was not argued until late in 1918. The court declares that supplementary evidence is needed. It permits the defendants to take the testimony of not more than three "sanitary or engineering experts" on (1) "any practicable modification of the proposed system of sewage treatment" that would lessen the alleged pollution, and (2) on "any practicable plan of sewage disposal or treatment" applicable to New York City sewage that would lessen the pollution of the harbor. In addition (3) both parties are authorized to take evidence on the degree of pollution of the harbor. The evidence in behalf of the defendants must be in by Aug. 15, 1919. Between then and Sept. 15 the defendants may, if desired, recall in rebuttal the experts who have testified under (1) and (2) and may also offer rebuttal evidence under (3). After the new evidence is all entered, a date for further argument will be set. The evidence will be taken by James D. Maher, clerk of the United States Supreme Court, sitting as a commissioner in New York and Newark. Mr. Maher took the earlier evidence in this case.

WATER SUPPLY

Water Rate Increases Replace Liquor Revenue Loss.

Camden, N. J.—The city council water committee has decided to solve the problem of how to make good the loss of income hitherto obtained from wholesale and retail liquor licenses after the country goes dry on July 1st by increasing the water rates so that they would yield an additional revenue obtained from local liquor licenses—$125,000 a year. On the day prohibition becomes effective Camden householders will begin paying a rental of $8 for outside and kitchen hydrants. The present cost is $5. Bathroom faucet charges will jump from $3 to $4 in one-family houses. Factories will be charged twenty-five cents a day for each 1,000 feet from one to 100 gallons instead of twenty cents as at present.

Water Causes Sickness of Hundreds.

Lansing, Mich.—Hundreds of people in all sections of the city have been made sick by the water supply. Contamination of the entire under strata of water which supplies the wells of the city water plant is the cause, according to the conclusion which has been reached by Major E. D. Rich, state sanitary engineer, based on the results of investigations and laboratory tests which have been going on night and day since the bad condition of the water was first discovered. Laboratory tests of the water from every part of the city, made in the laboratories of the state health department, showed that it was all unsafe to use. Tests of water taken direct from the different pumping stations showed it in every case to be of a dangerous character. State and city officials ordered the people to use only boiled or distilled water for drinking and cooking purposes. Emergency apparatus was immediately installed for treatment. As only a limited amount of water can be treated at a time, Guy C. Crane, manager of the city water plant, declared that the strictest economy in the use of city water for washing and all other general purposes would have to be observed. Practically all the water used came from the Pennsylvania avenue and central stations, amounting to less than 6,000,000 gallons every 24 hours, which is far short of the usual demands. So many were stricken that some departments in local factories had to shut down.

All Connections to Be Metered.

Niagara Falls, N. Y.—Following a resolution of city council, beginning June 1st, water will be sold by the bureau of water through meter only. It therefore will be necessary for all consumers now on flat rate to have a meter installed not later than that date. Meters will be furnished and installed by the city water departments at the actual cost of meter and installation. The city has on hand about 800 meters and until this supply is exhausted, the price of meter and installation will be $10.

STREET LIGHTING AND POWER

Commission Grants Increased Rates.

Noblesville, Ind.—The public service commission has issued an order authorizing the Indiana Gas Light Company, of Noblesville, to increase, for the period between March 21 and January 1, 1920, gas rates from $1.10 to $1.35 a 1,000 cubic feet for the first 5,000 cubic feet; from 85 cents to $1.25 a 1,000 for the next 50,000, and from 75 cents to $1.10 a 1,000 for consumption in excess of 55,000 cubic feet. The company supplies Noblesville, Tipton, Atlanta, Cicero and neighborhoods. It does not manufacture gas, but gets its supply from the Central Indiana Gas Company, of Muncie, which latter company produces artificial gas and also brings gas to Indiana from the natural fields in West Virginia. Recently the commission granted the Central Indiana company authority to increase its charge to the Noblesville company from 40 cents to 60 cents a 1,000 cubic feet of gas. In granting the Noblesville company the increased rates the commission yielded only partly to the petition of the company, declaring in its order that "the commission cannot fix rates which will yield income sufficient to meet fixed charges on $388,000 of bonds as compared with the $269,000 estimated value of the property." The commission estimated that the rates granted temporarily will yield the company 6½ per cent on the $269,000 tentative value of the company. "The rates established in this order," reads the document, "are based on the rendition of adequate service, and this petitioner will be required to use every means to maintain such service."

Central Electric Plants in New Jersey.

Washington, D. C.—Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of the state of New Jersey have been given out by the Bureau of the Census, Department of Commerce. The statistics relate to the years ending Dec. 31, 1917, 1912 and 1907, and cover both commercial and municipal plants. They do not, however, cover electric plants operated by factories, hotels, etc., which generate current for their own consumption; those operated by the federal Government and state institutions; and those that were idle or in course of construction. The report shows a pronounced growth in the amount of business done by the electric light and power stations. Their total income in 1917 was $23,480,320, representing an increase of 114.5 per cent since 1912, as compared with an increase of 83.9 per cent during the period 1907-1912. The income from electric service alone in 1917 was $20,188,244, an increase of 90.7 per cent for the

later five-year period, as against 79.1 per cent for the earlier. The total output of the stations was 781,230,790 kilowatt hours, an increase of 103.5 per cent between 1912 and 1917, as against 173.2 per cent for the preceding five years. The total expenses, including salaries and wages, amounted to $18,760,138, an increase of 100.7 per cent for the period 1912-1917, as compared with 103.3 per cent for the preceding five years. The relative increase in the amount of current generated was greater at each of the five-year periods than the increase in the income for electric service or in that for the total expenses. The stations employed 5,065 persons, to whom were paid salaries and wages aggregating $4,821,852. The rates of increase in the number of persons employed were 69.5 per cent for the period 1912-1917 and 69.9 per cent for the preceding five years, but the rates of increase in salaries and wages were considerably greater—94.5 per cent and 80.9 per cent for the later and earlier periods, respectively. The total primary horsepower, 96 per cent of which was derived from steam engines, was 367,743 in 1917, an increase of 53.5 per cent during the period 1912-1917, as against 155.9 per cent for the preceding five years. The kilowatt capacity of the dynamos was 249,521, an increase of 39 per cent between 1912 and 1917, compared with 154.3 per cent between 1907 and 1912. The horsepower of the stationary motors served was 262,858, an increase of 209.2 per cent over 1912, as against 208 per cent for the preceding five years. As in the cases of most of the states, the number of arc lamps used for street lighting shows a decrease, while a pronounced increase appears in incandescent lamps.

GOVERNMENT AND FINANCE

Former Manager Waite Meets German Burgomeisters.

Dayton, O.—Henry H. Waite, formerly city manager of Dayton and the leading figure among the city managers, resigned a year ago to enter the army as a colonel of engineers. He has just returned from France. Waite was assigned to deal with German municipal authorities in the areas taken by the American Army of Occupation, and was one of the few Americans who reached the Rhine before the German armies left. Knowing that German cities had for years been administered by professional chief administratives like himself, he was interested in putting them through their paces. He reports:

The German municipal authorities were extraordinarily efficient. They often gave us in a single day data which we requested and which we assumed would take weeks to compile. They had their facts always on tap and knew far more about the condition of their people than American municipal officials usually consider within the scope of their interests. Beyond all doubt the German mayor knows his job.

But the Germans don't have the city-manager plan. The resemblance is utterly superficial. The whole democratic spirit of our manager cities is missing. I talked with labor radicals, and apparently they had not even thought of the idea of electing friendly councilmen under the new democratic regime, and thereby keeping the magistrate under continuous and flexible control. They took it for granted that the administrators would do whatever they pleased. A government that would obey the rank and file of the people was a curious idea to them.

Mayor Indicted for Vice Bribery.

Los Angeles, Cal.—Mayor Frederick T. Woodman has been indicted on a charge of receiving a bribe for the protection of vice. George Brown and George Henderson were indicted on a charge of giving a bribe in connection with the same transaction. The indictment against mayor Woodman, stripped of its legal verbiage, charges him with "the crime of asking, receiving and agreeing to receive a bribe," a felony. The indictment recites that on or about January 1, 1919, the mayor agreed to accept from Brown and Henderson $25,000 in monthly payments of $2,500 each and that $2,000 was actually paid to a former newspaper man for the mayor, the payments being in return for alleged protection to Brown and Henderson in unlawful sales of liquor; in conducting houses of ill-repute without interference, and in conducting gambling places and games. The bond of each of the defendants—mayor Woodman, Brown and Henderson—was fixed at $10,000. Captain John D. Fredericks, attorney for Woodman, issued the following statement: "The return of the indictment against the mayor will at last furnish an opportunity to get out into the open all these charges of graft and bribery. It will put an end to these innuendoes involving the name of the mayor. At the proper time and place the mayor will appear and state the facts. He is entirely innocent of these charges." Mayor Woodman was selected for that office by a vote of the city council on September 6, 1916, to succeed C. E. Sebastian, who resigned from the mayoralty. Woodman was, prior to that time, the president of the Los Angeles Board of Harbor Commissioners. Woodman came to Los Angeles about ten years ago from Concord, N. H. In Concord he served for a time as attorney for the Boston and Maine Railroad, and was also sent to the New Hampshire Legislature for two terms, in 1900 and 1901. He is a widower and forty-seven years of age. He was reputed to be independently wealthy when he became mayor.

LEGAL NEWS

A Summary and Notes of Recent Decisions—Rulings of Interest to Municipalities

Civil Service—Exempt Firemen—Power of Removal by Mayor.

(N.Y.Sup.) Under civil service law, section 22, protecting exempt firemen against wrong by removal from office without cause, commissioner of public safety of city of Cohoes, though removable by mayor under section 62 of charter, being an exempt fireman, can be removed only for incompetency or misconduct.—People ex rel. Kennedy v. Foley, 172 N. Y. S. 279.

Determination of mayor of city as to existence of cause for removal of an officer is subject to review by courts.—Id.

Mayor of city, in determining whether there has been misconduct of another officer, whom he is empowered to remove therefor, is both complainant and tribunal, called upon to exercise a high degree of fairness, failing in which law provides method of review for officer proceeded against.—Id.

Power of Village Trustees to Establish Fire Limits.

(N.D.) Under Comp. Laws 1913, section 3861, subd. 3, authorizing village trustees to establish measures to prevent or extinguish fires, and in view of section 3599, subd. 47, village trustees may establish fire limits.—Village of Ashley v. Ashley Lumber Co., 169 N. W. 87.

The limits of a fire district must necessarily be largely left to the sound discretion of the administrative or legislative body which is authorized to create it.—Id.

Denial of power of village trustees to establish fire limits cannot be based on fact that power is clearly granted to cities by Cities and Village Act 1895, and Laws 1887, c. 73, and that such is not true in case of villages, or under Comp. Laws 1913, section 3861, subd. 3, authorizing villages to take measures to prevent or extinguish fires.—Id.

In action in equity, the court, after resolving doubt as to validity of village ordinance, creating fire limits, imposing penalties, etc., may order removal of a wooden building erected within fire limits, though generally speaking it is not a common-law nuisance.—Id.

The contention that establishment of fire limits would be unnecessary in villages, though reasonable in cities, and that courts must credit Legislature with knowledge thereof, is without merit, in view of fact that danger from fire is greater in villages than in larger cities and that need of precautions is more necessary.—Id.

An ordinance of village trustees establishing fire limits was not arbitrary and unreasonable and discriminatory, though large part of village, including garage, etc., was not included therein.—Id.

NEWS OF THE SOCIETIES

April 9-10.—INDIANA SANITARY AND WATER SUPPLY ASSOCIATION. Twelfth annual meeting, Independent Athletic Club, Indianapolis, Ind. Asst. secretary, J. A. Craven, Board of Commissioners, Indianapolis Sanitary Dist., Indianapolis, Ind.

April 14-19.—UNITED STATES GOOD ROADS ASSOCIATION. Annual convention, Mineral Wells, Tex. Secretary, F. A. Rountree, Birmingham, Ala.

April 16-17.—AMERICAN WATER WORKS ASSOCIATION, IOWA SECTION. Fourth annual meeting, State University, Iowa City, Ia. Acting Secretary, J. H. Dunlap, State University.

April 25-26.—AMERICAN ACADEMY OF POLITICAL AND SOCIAL SCIENCE. Annual meeting, Philadelphia, Pa. Secretary, J. P. Lichtenberger, Logan Hall, West Philadelphia, Pa.

May 6-8.—NATIONAL FIRE PROTECTION ASSOCIATION. Annual convention, Ottawa, Can. Secretary, Franklin H. Wentworth, 87 Milk St., Boston, Mass.

May 13-14—AMERICAN ASSOCIATION OF ENGINEERS. Annual meeting, Chicago, Ill. Secretary, C. E. Drayer, 29 South LaSalle St., Chicago, Ill.

May 14-15.—LEAGUE OF TEXAS MUNICIPALITIES. Seventh annual convention, Sweetwater, Tex. Secretary-treasurer, Frank M. Stewart, University of Texas, Austin, Tex.

May 19-24.—NATIONAL ELECTRIC LIGHT ASSOCIATION. Annual convention, Atlantic City, N. J. Secretary, T. C. Martin, 29 W. 39th St., New York.

June 9-13.—AMERICAN WATER WORKS ASSOCIATION. Thirty-ninth annual convention, Iroquois Hotel, Buffalo, N. Y. Secretary, J. M. Diven, 47 State street, Troy, N. Y.

June 17-20.—AMERICAN SOCIETY OF CIVIL ENGINEERS. Annual meeting, St. Paul-Minneapolis. Secretary, Charles W. Hunt, 33 W. 39th St., New York, N. Y.

June 24-27.—AMERICAN SOCIETY FOR TESTING MATERIALS. Twenty-second annual meeting, Hotel Traymore, Atlantic City, N. J. Secretary, University.

June 24-27.—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual convention, Kansas City, Mo. Secretary, Gen. Fire Marshal James McFall, Emergency Fleet Corporation, U. S. Shipping Board, Philadelphia, Pa.

Nov. 12-14.—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention, New Orleans, La. Secretary, Charles C. Brown, Bloomington, Ill.

American Waterworks Association.

The thirty-ninth annual convention of the American Waterworks Association is to be held in Buffalo, N. Y., June 9-13, with headquarters at the Iroquois Hotel.

The secretary, J. M. Diven, has sent out a call for information for the members of the various committees. It is requested that all questionnaires on the subject of "Private Fire Protection Services" be answered and sent in to the chairman of the committee, Nicholas S. Hill, Jr., 100 William street, New York, N. Y. The committee on "Cold Weather Troubles," Charles R. Bettes, chairman, Queens County Water Co., Far Rockaway, N. Y., wants information about frozen mains, services and hydrants, and means for preventing or remedying them, particularly thawing apparatus.

Information for the committee on "Official Standards of Water Analysis" should be sent to the secretary of the association as the chairman of the committee, Jack J. Hinman, Jr., State Board of Health, Iowa City, Ia., is with the A. E. F. in France. The committee on "Revision of Standard Specifications for Cast-Iron Pipe and Specials," of which John H. Gregory, Johns Hopkins University, Baltimore, Md., is chairman, hopes to get an after-the-war agreement on these standards and to have a universal standard.

At the coming convention the manufacturers and supply houses will make special efforts to present attractive and instructive exhibits.

International Association of Fire Engineers.

The forty-seventh annual convention date and place has been announced by secretary McFall, of the International Association of Fire Engineers. The meeting will be held in Kansas City, Mo., on June 24-27. The president of the association is Chief A. A. Rozetta, Nashville, Tenn.

Southwestern Waterworks Association

The next meeting of the Southwestern Waterworks Association will be held in Kansas City, Mo., June 23, 24, 25 and 26. R. E. McDonnell, of the consulting engineering firm of Burns & McDonnell, of Kansas City, is chairman of a local committee making preparations for this convention. An attendance of about 200 to 225 waterworks superintendents and other officials is expected.

Indiana Sanitary and Water Supply Association.

In affiliation with the Indiana State Board of Health the Indiana Sanitary and Water Supply Association will hold its twelfth annual meeting at the Independent Athletic Club, Indianapolis, on April 9 and 10.

The Wednesday morning session will be opened by the address of the president, Dr. W. F. King, assistant state health commissioner of Indiana, and the report of the secretary-treasurer, J. A. Craven, member of the board of commissioners, Indianapolis Sanitary District.

There will be a round-table discussion on "Waterworks Accounting and Financing," led by H. W. Painter, auditor of the Indianapolis Water Co. The following papers will be read: "Recent Legislation and Legal Decisions Affecting the Public Utilities," Howard A. Dill, general manager, Richmond City waterworks; "Standards of Water Supplies for Interstate Carriers," J. O. Cobb, senior surgeon, U. S. Public Health Service; "The Bacteriological Standards for Drinking Water Supplies in Interstate Commerce," Everett Judson, bacteriologist, U. S. Public Health Service.

At the luncheon Dr. J. N. Hurty, state health commissioner, will deliver an address on "Additional Lessons to Be Learned from the Recent Physical Examinations of Our Young Men."

The afternoon session will be opened by a paper on "Recent Advancement in Sanitation in Indianapolis," by B. J. T. Jeup, chief engineer, Indianapolis Water Co. The following papers will then be presented: "The Financial Side of the Private Well and Privy Vault—Can the Public Afford to Tolerate These Menaces?" by Robert E. Tracy, director, Bureau of Municipal Research, Indianapolis Chamber of Commerce; "The Relation of the Private Well to Typhoid," by H. E. Barnard, state food and drug commissioner; "The Government Plan for Control of Venereal Diseases," by Dr. King, with discussion led by Senior Surgeon Cobb; "Crenothrix Removal," by W. F. Monfort, consulting engineer, St. Louis, Mo.; "Purification of Water Supplies," by L. H. Goebel, engineer, Chicago, Ill.

At the dinner in the evening E. I. Lewis, chairman of the public service commission of Indiana, will deliver an address on "The Financial Otulook for the Public Utility," with special reference to expenditures for extensions, improvements, etc. Lieutenant-Colonel E. D. Clark, M. D., will tell the story of "Base Hospital No. 32 in the World War."

On Thursday morning there will be an automobile trip for all, which will include a visit to the new laboratories of the State Board of Health, the Government laboratory car, the Kentucky avenue plant of the Indianapolis Light & Heat Company and the Kingan & Company, Ltd., packing plant. The luncheon will be at the Riverside pumping station of the Indianapolis Water Company.

In the afternoon the following subjects will be taken up: "Proper Regulations Governing Private Fire Protection Lines" (round-table discussion), by Dow R. Gwinn, president, Terre Haute Waterworks Co.; "Equitable Rates for Water Service in Smaller Cities," by Philip Burgess, consulting engineer, Columbus, O.; "Utility Operation in Army Training Camps," by Captain H. E. Jordan, in charge of utilities, Camp Sevier, S. C.; "Some Interesting Experiences in the Operation of Camp Utilities," by John W. Toyne, captain, Q. M. C., U. S. A., in charge of utilities, Fort Oglethrope, Ga.; "Fire Inspection in Indianapolis—How Conducted—Results," by Jacob H. Hilkene, director of fire prevention, discussion being led by H. H. Friedly, state fire marshal; "Efficient Operation of the Water Department," by H. M. Ely, superintendent, Interstate Water Co., Danville, Ill., with round-table discussion on over-sizing of meters, repairing, testing, etc.

At the dinner in the evening mayor Charles W. Jewett, of Indianapolis, and governor James P. Goodrich, of Indiana, will deliver addresses. Lieutenant-Colonel Solon J. Carter, 150th Field Artillery, Rainbow Division, will recite some of his interesting experiences "Over There." Following this there will be a social session, with dancing and cards.

INDUSTRIAL NEWS

Cast-Iron Pipe and Steel.—Following the announcement of reduced pig-iron prices by the government and producers' conferences cast-iron pipe manufacturers reduced their prices by $5 a ton. It is expected that the reduction will bring out new business.

The New York Continental Jewell Filtration Co., Nutley, N. J., announces with deep sorrow the death on February 25, 1919, of Mr. Robert E. Milligan, for many years general manager of the company.

Carson Petroleum Co., 208 South La Salle street, Chicago, Ill., announces the appointment of Mr. George Fuchs as southern representative of its asphalt and road oil sales department, with headquarters at 208 Cardy street, Tampa, Fla. Mr. Fuchs was formerly connected with The Texas Company's asphalt sales department.

Allis-Chalmers Mfg. Co., Milwaukee, Wis., in its March issue of the "Centrifugal Pump Users' Guide," offers for immediate delivery a large number of 3 phase, 60 cycle motor driven, type "S" centrifugal pumping units. They are double-suction, bronze fitted, split-casing pumps direct-connected to Allis-Chalmers squirrel cage motors with potential starters. Sizes range from 2 inch and 2 h. p. to 12 inch and 200 h. p.

Dunn Patents Sustained.

The Dunn Wire-Cut Lug Brick Company, of Conneaut, O., has been given the decision by the United States Circuit Court of Appeals of the Sixth District in its suit against Joseph Nicholson, et al., of Toronto, Ohio, for infringement of patent. The court affirmed the validity of the Dunn patent on wire-cut lug paving brick, and states that an injunction should issue against Nicholson, restraining him from making or selling the brick claimed by the complainant to be an infringement of the Dunn patent, and an accounting should be made by Nicholson to the Dunn Wire-Cut Lug Brick Company. This decision sustains every claim made by the Dunn company under the patents on paving brick taken out by Frank B. Dunn and owned by the Dunn Wire-Cut Lug Brick Company.

The case has been in the courts for two years, and the result will be of great interest to the paving brick industry throughout the country, as wire-cut lug brick are being made by 48 companies, operating 72 plants in 12 states, and they are in general use in the United States and Canada.

The suit grew out of the making and selling by Joseph Nicholson, et al., of Toronto, O., of a wire-cut brick having lugs cut with a knife instead of wires. The Dunn company sued Nicholson for infringement, claiming that the Nicholson brick was a wire-cut lug brick within the meaning of the law and the understanding of the trade.

The Circuit Court of Appeals sustained this contention. It held that the method of cutting the lugs made no difference, since whether the cutting be done by wire or knife or saw the methods are equivalent, and the Dunn company is entitled to the protection of equivalent methods. A cutting wire, says the court, acts like the cutting edge of a knife, and the cutting edge of a knife is, for this purpose, a wire; hence all such brick, whether sliced by wire or knife or saw, are in trade universally known as wire-cut brick; that Dunn's patent entitles him to the breadth of equivalency pertaining to an invention of that character.

Both the Circuit Court and the Circuit Court of Appeals concurred in the finding regarding the Dunn wire-cut lug brick that "the demand for this brick following the test of actual service was such that the output rose from 2,233,000 in 1910 to 138,000,000 in 1915."

"How It's Done."

Under the above title the **Central Foundry Co.,** 90 West street, New York, N. Y., has issued a booklet on the installation of Universal cast-iron pipe. Just how a Universal joint is made is described briefly, but adequately, and the subject is illustrated by explanatory cuts.

The Eastern Paving Brick Manufacturers' Association has elected Wm. C. Perkins, M. Am. Soc. C. E., for the past six years chief engineer of The Dunn Wire-Cut Lug Brick Company, of Conneaut, O., chief engineer and general manager of the association, comprising 35 companies with shipping territory covering Pennsylvania, West Virginia, Maryland, Delaware, New Jersey, New York and the New England states. Headquarters will be established in Philadelphia. Mr. Perkins was formerly resident engineer at Buffalo for the New York state highway commission. He went with the Dunn Wire-Cut Lug Brick Company in 1913, and during his connection with that company his duties called him to all parts of the country. His acquaintance with highway engineers is nation wide.

The Flower-Stephens Mfg. Co., Detroit, Mich., has changed its name to **The Flower Valve Mfg. Co.** The goods manufactured by this firm under the trade name "Michigan" have been well known for nearly seventy years. The original firm of James Flower and Brothers was formed in 1852, to manufacture valves and hydrants, as well as a line of ship equipment. The latter line was eventually dropped and all their energies devoted to making hydraulic supplies. Under the leadership of John W. Flower, president of the company and a son of the founder, the business has grown rapidly to its present dominant position in its field. When this country entered the war, the plant was placed at the disposal of the government and because of the officials' long experience in ship fitting, they were asked to make materials for the ships built under the direction of the Shipping Board, as well as to supply their regular product for camps and cantonments, here and abroad. Propellers, throttle valves, bilge piping, ballast piping and valves, strut bearings and stern bearings were turned out, sufficient to equip twenty-five ships per month. This work was so well done that official recognition came to them in the form of special commendation for both the high standard maintained and the quantity produced.

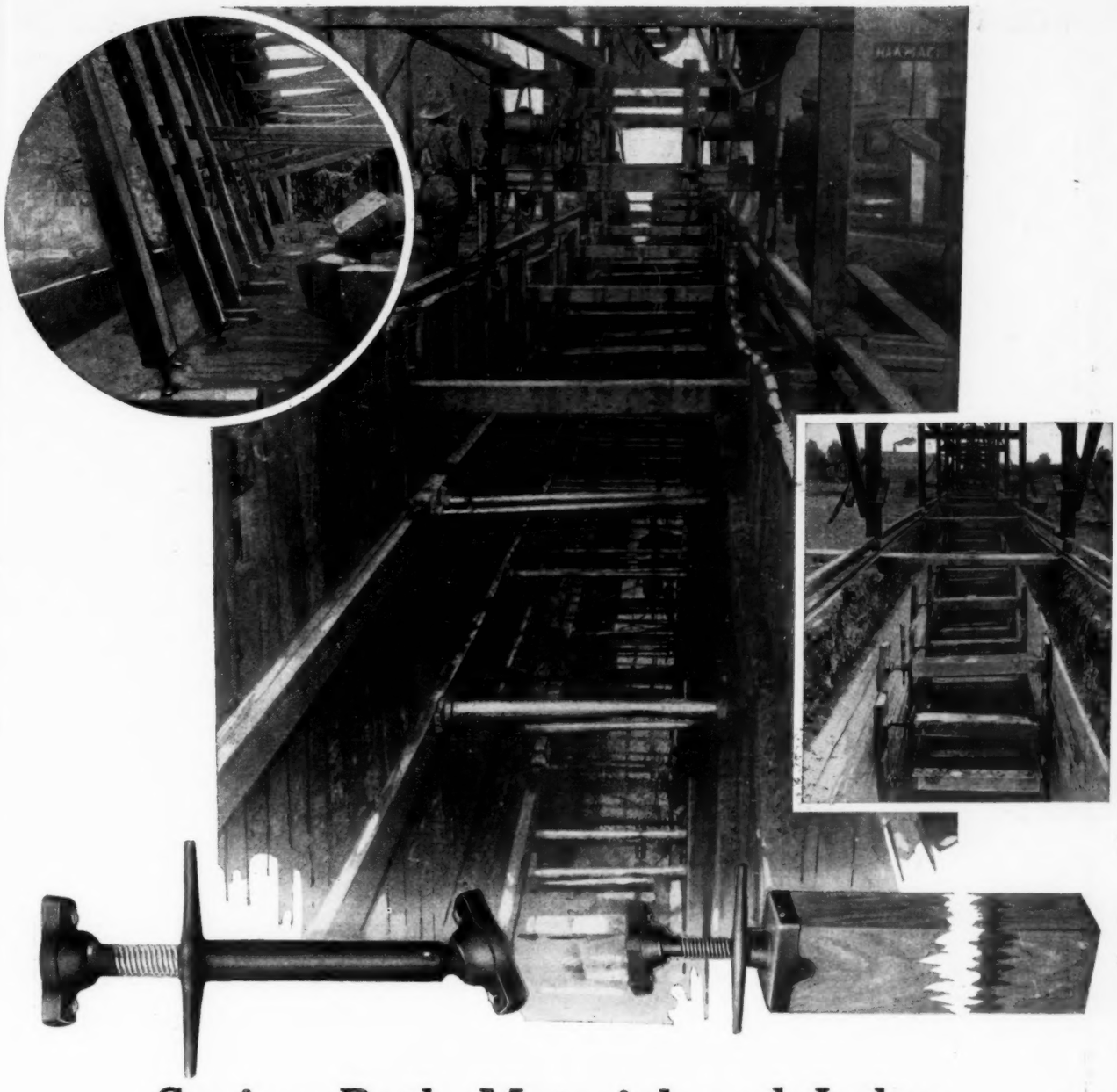
PERSONALS

Gregory, John H., has recently assumed his duties as professor of sanitary engineering at Johns Hopkins University. In connection with his work at the university he will also continue his private practice. Professor Gregory graduated from the Massachusetts Institute of Technology in 1895, since which time he has been engaged in engineering work connected with sewerage, water supply and refuse disposal. He has been connected with the Metropolitan Water Board of Boston, the Jersey City Water Supply Company, the Commission on Additional Water Supply for New York City and the Metropolitan Sewerage Commission of New York. For several years prior to 1917 he was associated in consulting work with Rudolph Hering, since which time he has been engaged in private practice.

Flynn, John, Jr., who was recently project and supervising engineer, United States Housing Corporation project, Watervliet, N. Y., has been appointed village engineer of Green Island, N. Y., for the ensuing year.

Welch, Major W. A., Air Service, Aircraft Production, U. S. A., division engineer of the Spruce Production Division, U. S. A., and chief engineer of the Spruce Production Corporation, has been discharged from the service and has resumed his former position as chief engineer of the Palisades Interstate Park Commission of New York and New Jersey.

Elrod, Henry E., David Drennan and Frank S. Taylor, formerly of the engineer firm of Lyndon, Taylor & Perrilliat, New York City and New Orleans, have become associated under the firm name of the Henry Exall Elrod Co., Dallas, Tex., consulting engineers, successors to Henry Exall Elrod. The new organization will continue to specialize in municipal work, utility valuation and regulation, and highway engineering.



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The above photographs are convincing illustrations of efficiency in subway and trench bracing. The use of Duff (Dunn Patent) Trench Braces on these jobs was instrumental in cutting Material and Labor costs to the extent of many dollars.

Had plain timber braces been used it would have taken many men many hours to measure and cut them, and wedge them into place. Duff Braces were screwed into place by fewer workmen and in less than one-third the time.

Duff Braces are taken out of a trench or excavation in even less time than it takes to place them in. Being extensible and practically indestructible they are used year in and year out on jobs of varying sizes. Where a new job varies greatly in size from the last one, it is only necessary to change the barrel of each brace, using a shorter or longer one as the case may be. The barrel is merely plain gas pipe and can be bought anywhere.

Duff Braces are economical on small jobs as well as large work. The cost of Duff Braces is often saved on the first contract.

Cave-ins—always a dangerous possibility with plain timber braces—are made impossible by the ball and socket shoes, with lugs on the bearing surfaces.

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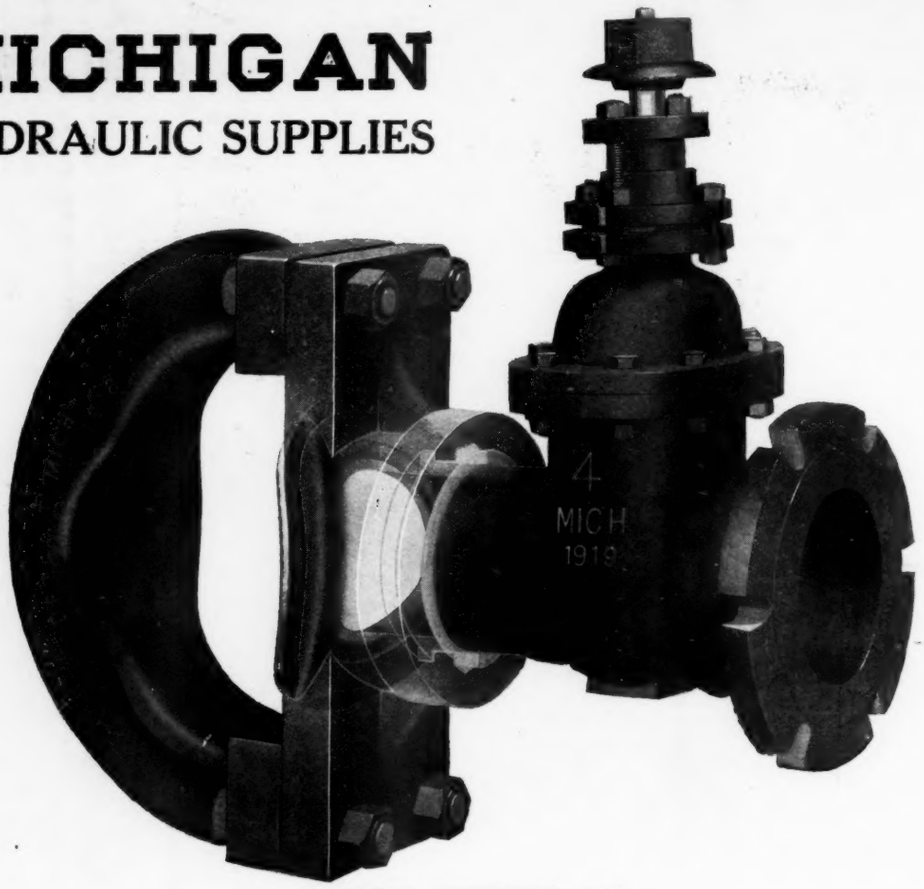

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